Synthesis and characterization of Metal Oxide nanoparticles (Cu, Zn, Fe, Ce) and their applications in Biological field

A Synopsis

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Supervised by Dr. Gaurav Verma

Submitted By Sumit Yadav
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Department of Physics, Faculty of Science

JayotiVidyapeeth Women's University, Jaipur

(Rajasthan)

INTRODUCTION

In last few decades in the research of science and technology researcher candidates found a unusual properties of Nenoparticles (NP). Researcher found the different and various Biomedical application. Neno particles easy uses of Diagnostic and therapeutics.Nenoparticles easily permits control synthesis of materials. Neno particles are also used in drug delivery because of less side effect. Metal oxide Nenoparticles such as Zinc Oxide, Ironoxide, copper oxide, cerium oxide have been suggested for immobilization of desired molecules. Nenoparticles have a unique property it emphasis fast transfer electron from electrode and target site of enzyme. The use of nanoparticles (NP) material gives many good advantage because of their very small size and due to their various useable physical properties.

Nanoparticles have unique microscopic physical, chemical, thermal and mechanical properties and super paramagnetic properties offer good and various unique advantages for different and various biomedical application. Nanoparticles also use for cellular therapy and tissue repair. Nenoparticles have unique magnetic properties. By magnetic properties. It is use in magnetic field-guided carriers for localizing drugs as radioactive therapies. MegneticNenoparticles can bind to drugs and takes as the target tumar cancer cells and kill only tumor cells. Magnetic Nenoparticles are very useful is the magnetic resonance imaging (MRI).

For a large number of uses in biological and biomedical application, magnetic Iron oxide Nenoparticles are the First choice, because it have super magnetic behaviour and chemically stable. The nanostructure is based on an inorganic core of iron oxide like as magnetite (Fe_3O_4) and magthemite (v- Fe_2O_3)coated with polymer such as dextran, chitosan and poly ethylene glycol. Copper oxideNenoparticles have widely use in modern technology and newly medicine because of their non-harm properties, and easily availability. There is an increasing interest in copper Nenoparticles due to their optical, catalytic, mechanical and electrical properties. Copper oxide Nenoparticles is a powder soluble in dilute acid and insoluble in water. Cerium oxide Nenoparticles are used in widely Medical Sciences. Cerium oxide Nenoparticles (CeO_2NPs) also known as nanoceria. Cerium oxide Nenoparticles are used in solar panels, fuel cells, or diesel fuel additive.

Zinc oxide Nenoparticles (ZnONPs) have high antibacteral, antimicrobial and excellent ultra violet stopping properties. ZnONPs have various antibacterial, cell imaging and other biomedical properties.

Review of Literature

ManishaKhaldakar et al (March 2017)[1]

Transition metal have different oxidation state. Transition metal oxide have various geometrical structure. Because transition metal have different

geometrical structure, so that's why it have different chemical and electronic properties. Metal oxide Nenoparticles have very small size so have different properties in comparisionfor those type of particles found in big size.

A large number of metal oxide present in the nature but some metal oxide Nenoparticleshave some unique and useful properties in your daily life application and Bio Medical. Chemical properties of metal oxide Nenoparticles are use in many industrial application. Metal oxide Nenoparticlesare use in sensors, ceramics and many catalyst. The oxide of transition metal are an important which is use solar energy transformation, Magneticstorage media, electronics and catalyst among the oxide of transition metal.

Zinc oxide Nenoparticles (ZnONPs) Dalia Ahmed et al (2015)[(2)]

Zinc oxide Nenoparticles (ZnONPs) is an important metal oxide. It is environmental friendly. It have use in many application. It have very diverse properties which is totally depends upon their morphology. So it is used in industry, technical and biomedical application. It is non-toxic.

Application –

1. Zinc oxide Nenoparticles (ZnONPs) have anticancer properties[(3)]
2. Zinc oxide Nenoparticles (ZnONPs) is antibacterial[(4)]

Iron oxide Nenoparticles (ZnONPs)-Ali HraZafaret al (2016)[(5)]

Iron oxide Nenoparticles (ZnONPs) are very important for scienticfic technology. The three most common form iron oxide in nature are magnetite (Fe_3O_4), maghemite (v-Fe_2O_3)and hematite (<-Fe_2O_3). FeONPs have their low toxicity, super paramagnetic properties, Iron oxide NPs have much uses in biomedical application due to their magnetic propeties.

Application

(i) FeONPs have used in biomedical.

(ii) FeONPshava used in making anticancer drugs.

(iii) FeONPshava used in antibiotic.

(iv) FeONPshava used in antifungal.[6]

(v) FeONPshava used in Nanocan for vaccination.

CopparoxideNenoparticles (CuONPs)-Jagpreet Singh et al (2016)[8]

Coppar oxide Nenoparticles is powder soluble in dilute acid, NH_4CL,

$(NH_4)_2Co_{3,}$ insoluble in water. It is dissolves slowly in alcohals. CuONPs have high catalytic properties. Particle size of CuONPs is between 1-100 nm.

Application

It have antibacterial and antimicrobial properties.[9,10]Coppar oxide Nenoparticlesare used to diseases detection and detection of virus in human bodies.

Cerium oxide Nenoparticles (CeONPs)-Y.H.Liuet al (2014)[11]

Cerium oxide Nenoparticles (CeONPs) are used in various biomedical application. CeONPs having diameter 200-300 nm.It's uses in high storage capacitor devices, buffer layer for conductor, fuel cells, optical devices, UV-blocks etc. CeONPs are synthesized via a precipitation method.

Application

CeONPs uses in to regeneration of damage tissues and have antioxidant[12], antibacterial[13],anti-inflammatory[14], properties. it have neuro degenerative effect[15],

Objective

1. Synthesis the metal oxide nanoparticales. Zinc, Iron, Copper, Cerium, (Zn, Fe, Cu, Ce) by chemical routes method.

2. Characterized by various technique - XRD (X-ray Powder diffraction), AFM (atomic force microscope) ,SEM (Scanning electron microscope), FTIR (fourier transform infra-red spectroscopy), TEM (Transmission-electron miscrospe), Electrical properties, Biological activities.

3. Analyzing various biological properties of metal oxide nenoparticales

Methodolgy

Synthesis of metal oxide nanoparticales

Preparation of zinc oxide nanoparticales (ZnONPs), Iron oxide nanoparticales (FeONPs), Copper oxide nanoparticales (CuONPs) Cerium oxide nanoparticales (CeONPs) by chemical routes method (Precipitation and sol-gel method)

Preparation of zinc oxide nanoparticales (ZnONPs)

Preparation of zinc oxide nanoparticales (ZnONPs) by Precipitation method

$Zn(CH_3COOH)_2.\ 2H_2O + 2LiOH \rightarrow Zn(OH)_2 + 2CH_3COOLi + 2H_2O$

$Zn(OH)_2 + 2H_2O \rightarrow Zn(OH_4)^{2-} + 2H^+$

$Zn\ (OH_4)^{2-} \rightarrow Zno + H_2O + 2H^-$

Preparation of Iron oxide nanoparticales (FeONPs)

we generally use (FeONPs) by the aqueous co-precipitation method, salts Fe^{2+} and Fe^{3+} ions suffer co-precipitation in a normal solution at room temperature and we get nanoparticales of (FeO) In the variation in PH of the precipitates and in the amount of sodium hydroxides.

(FeONPS) of different size forms preparation of (CuoNPS) CopperoxideNeno Particles

Here we also make cuoNPS by precipitation method like as copper nitrate tri hydrate 0.02 Solution was prepared in distilled water. Then sodium hydroxide was added to the solution under constant Stirring. After Completing the reaction a blue or black solution are formed. This solution again heated and refluxed under stirring and control the temperature. In this precipitate are formed washed it properly and died it at room temperature preparation of (CeO_2NPs) ceriumoxidenano particles.

Cerium oxide nano particles are formed by chemically precipitation method. Precipitate can be formed dried it and we can ged cerium oxide nanoparaticles.

Synthesized (Metal oxide nanoparticales) will be characterized by various following techniques.

(1) X.R.D. (X-ray diffraction) will be used to study the phase structure and crystal structure**.**

X.R.D. (CeONPs)Graph(21)

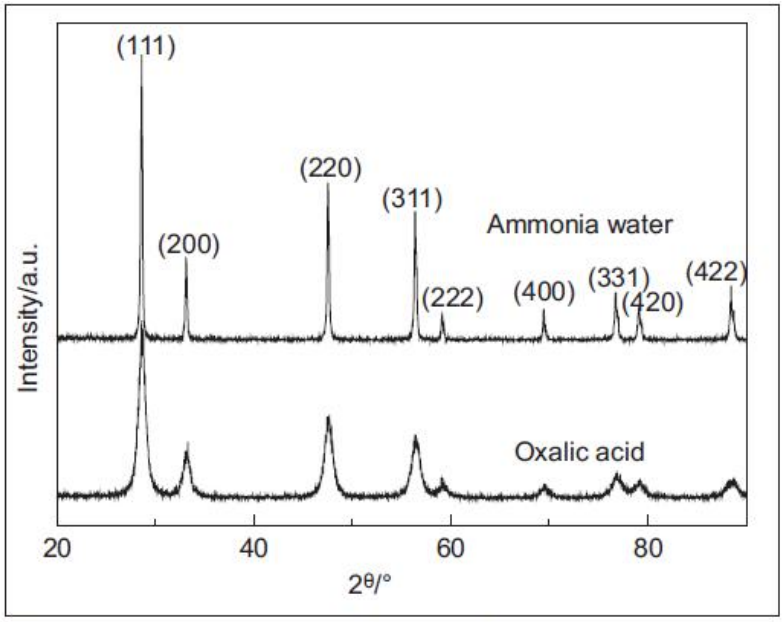
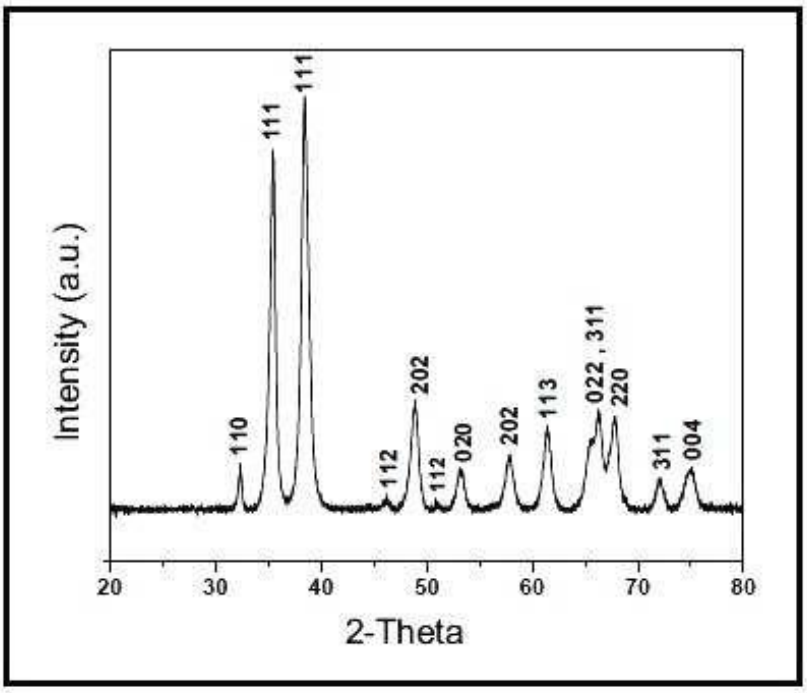
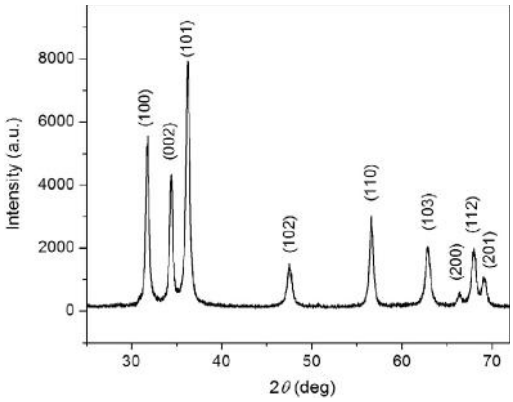


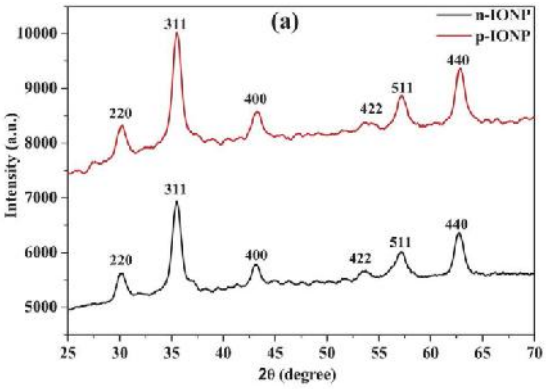
Figure 1 XRD pattern of the CeO_2 particles synthesized using different precipitant

X.R.D. (CuONPs) Graph(19)



X.R.D. (ZnONPs) Graph(15) **X.R.D.(FeONPs)Graph(17)**



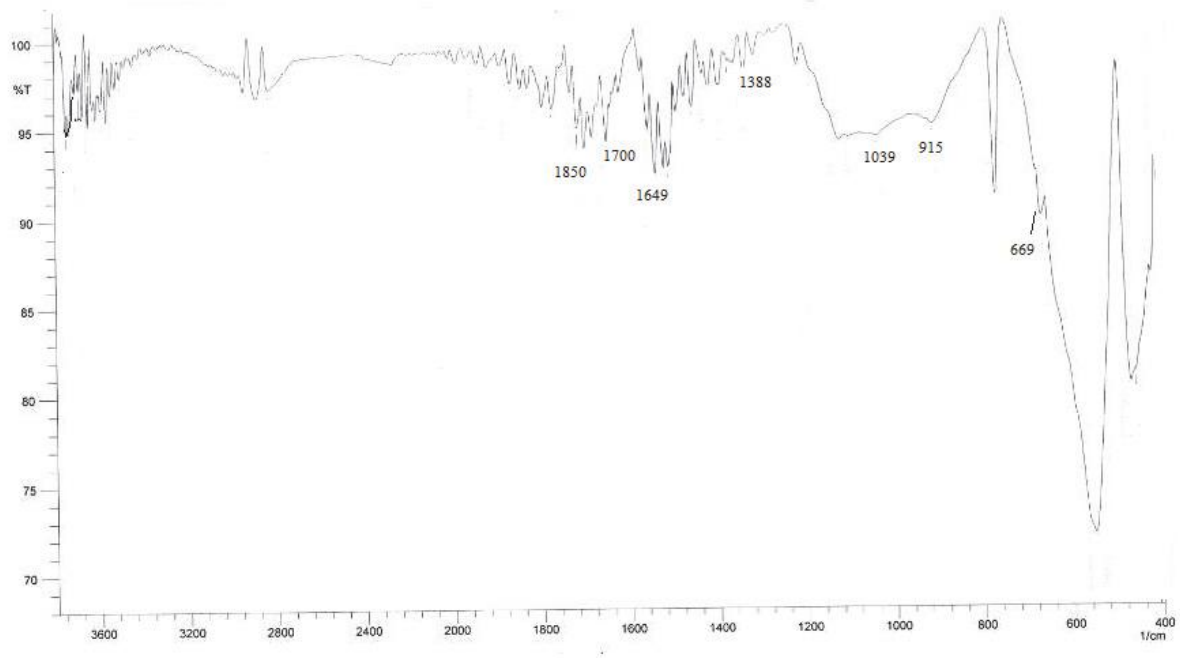


(2) S.E.M (Scaning Electron Mircosope) will be used to study the surface structure, surface 3D structure.

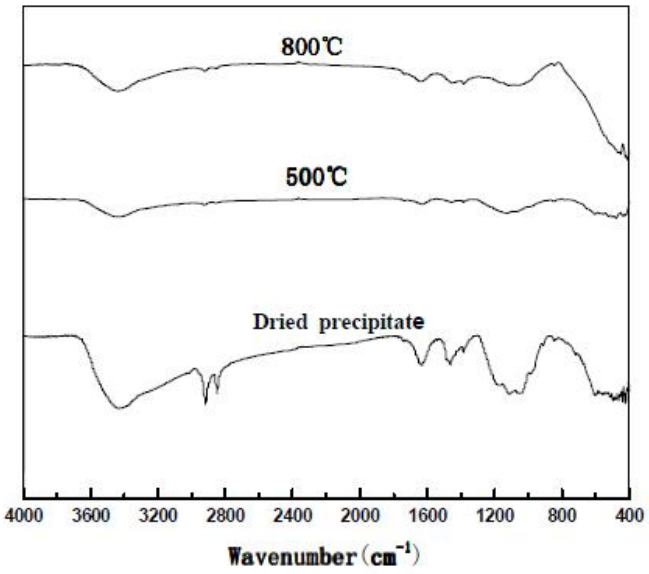
(3) T.E.M (transmission Electron Microscope) will be used to study the topographical morphological compositional and crystalline information of sample.

(4) F.T.I.R. (Fourier Transform Infrared spectroscopy will be used for infrared properties.

F.T.I.R. (FeONPs) Graph(18)

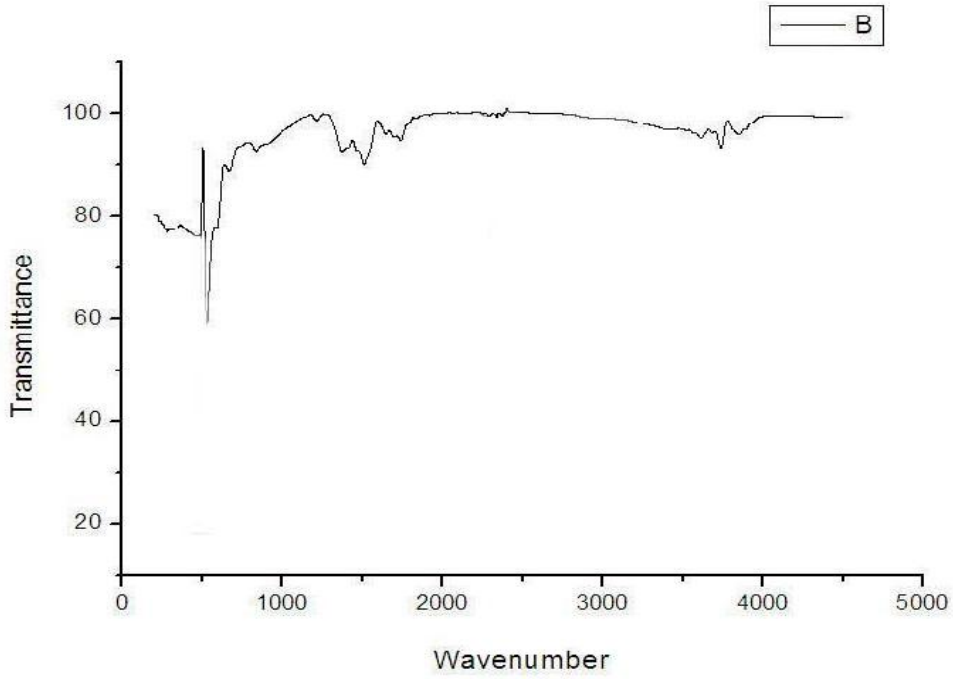


F.T.I.R. (CeONPs) Graph(22)

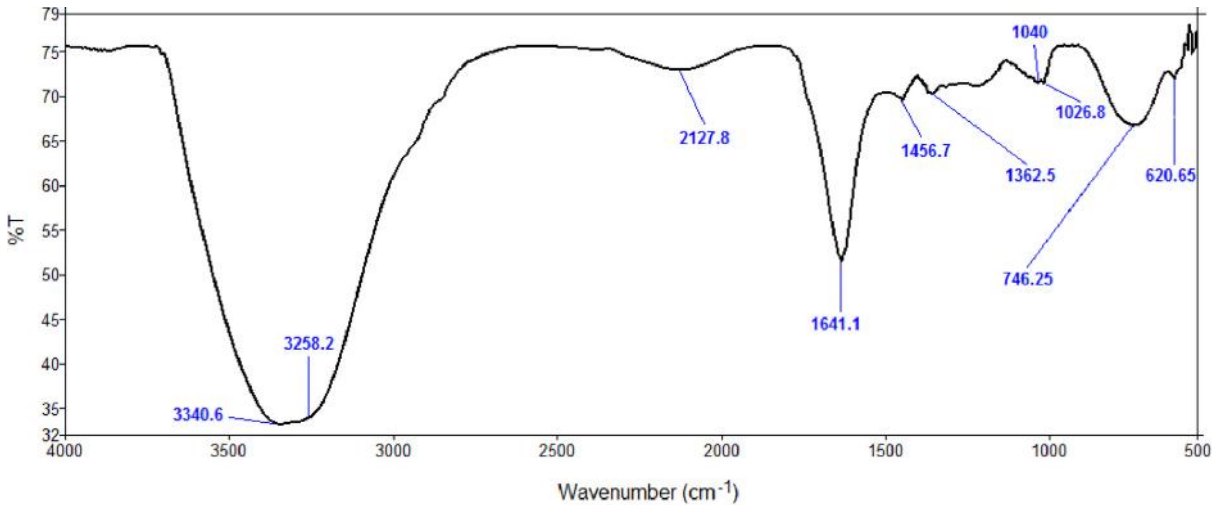


FT-IR spectra of as-systhesized dried precipitate,calcined at 500 ℃ and 800 ℃

F.T.I.R. (CuONPs)Graph(20)

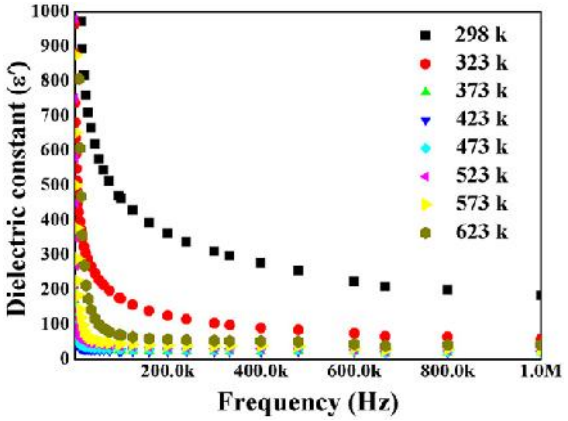


F.T.I.R. (ZnONPs) Graph(16)



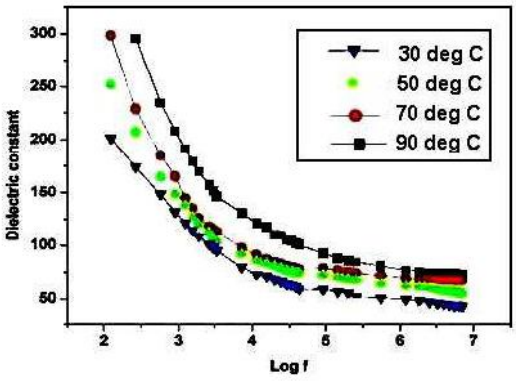
(6) Electrical Properties will be characterized

CeONPs (23)



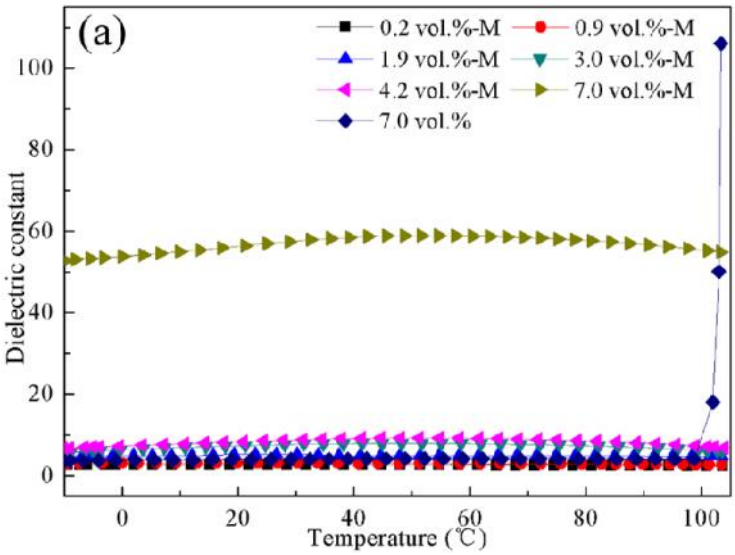
The dielectric loss CeO2 nanoparticles versus frequency of applied field at varioustemperatures.

CuONPs(24)

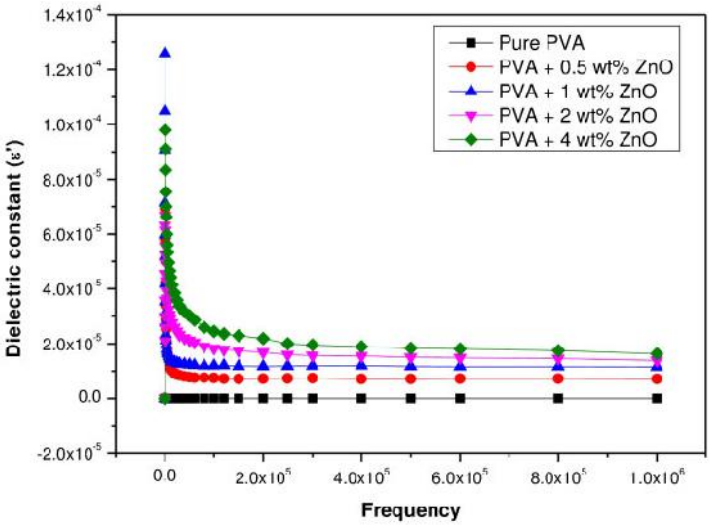


Dielectric constant of CuOnanoparticles, as a function of frequencyat different temperatures

FeONPs(25)

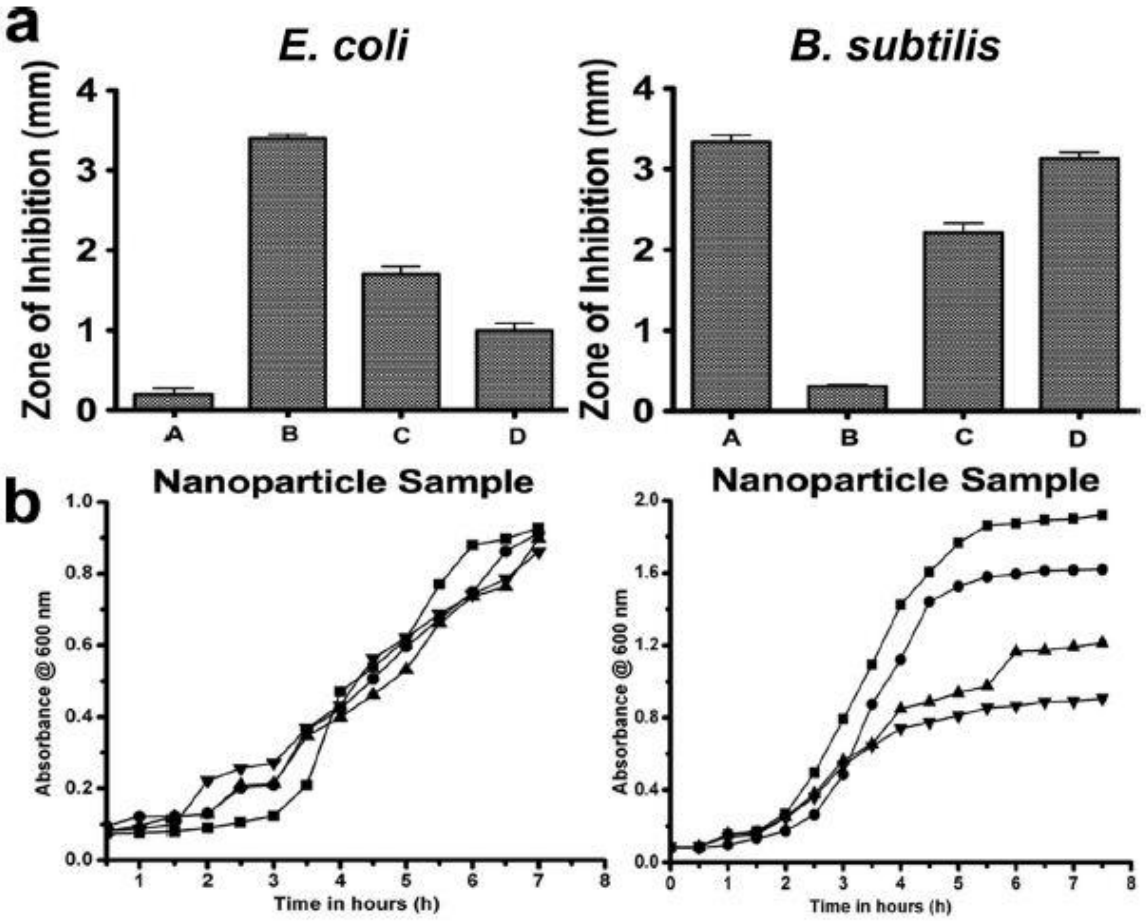


ZnONPs(26)

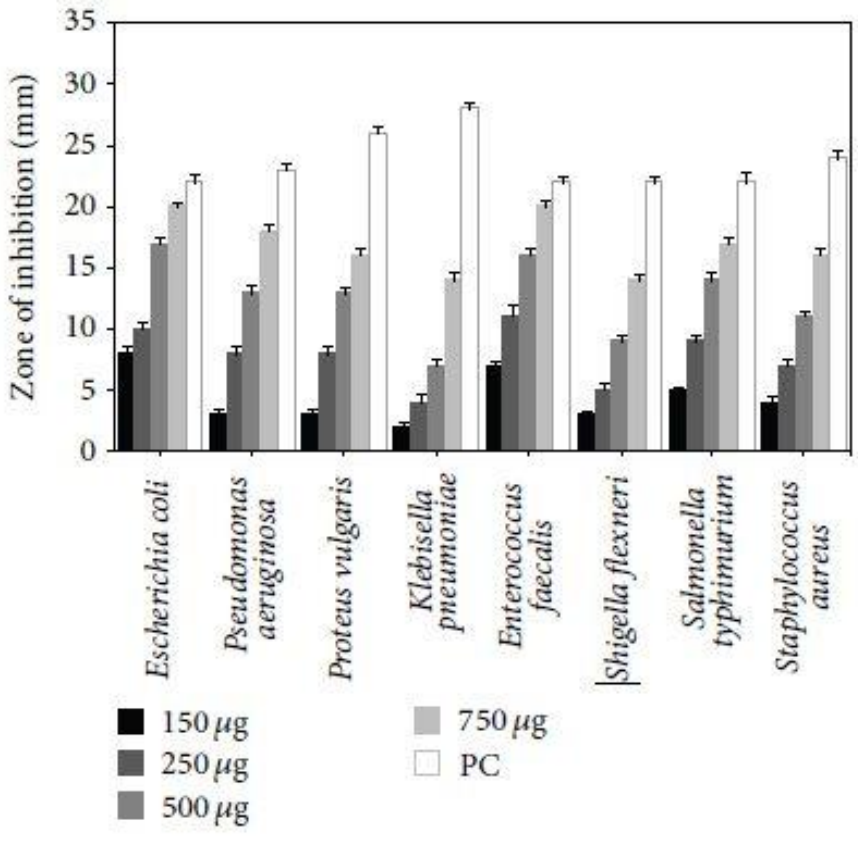


(7) Bio-logical activitieswill be characterized

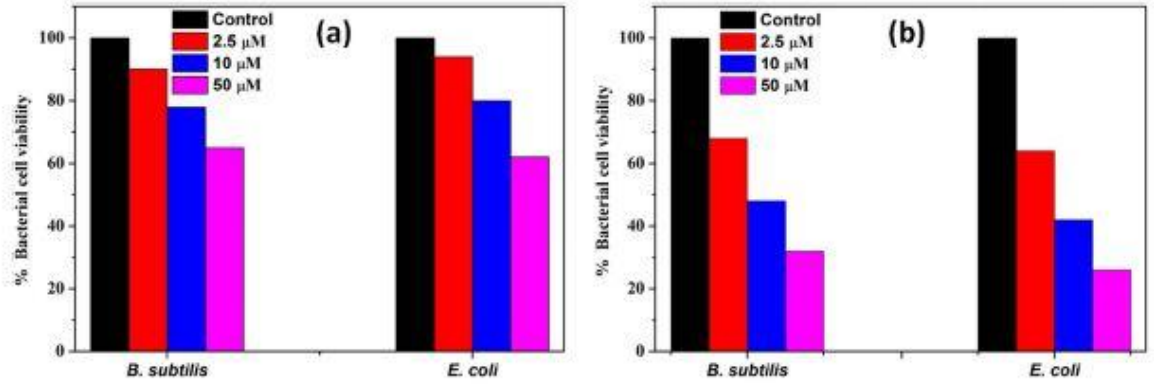
CeONPs (27)



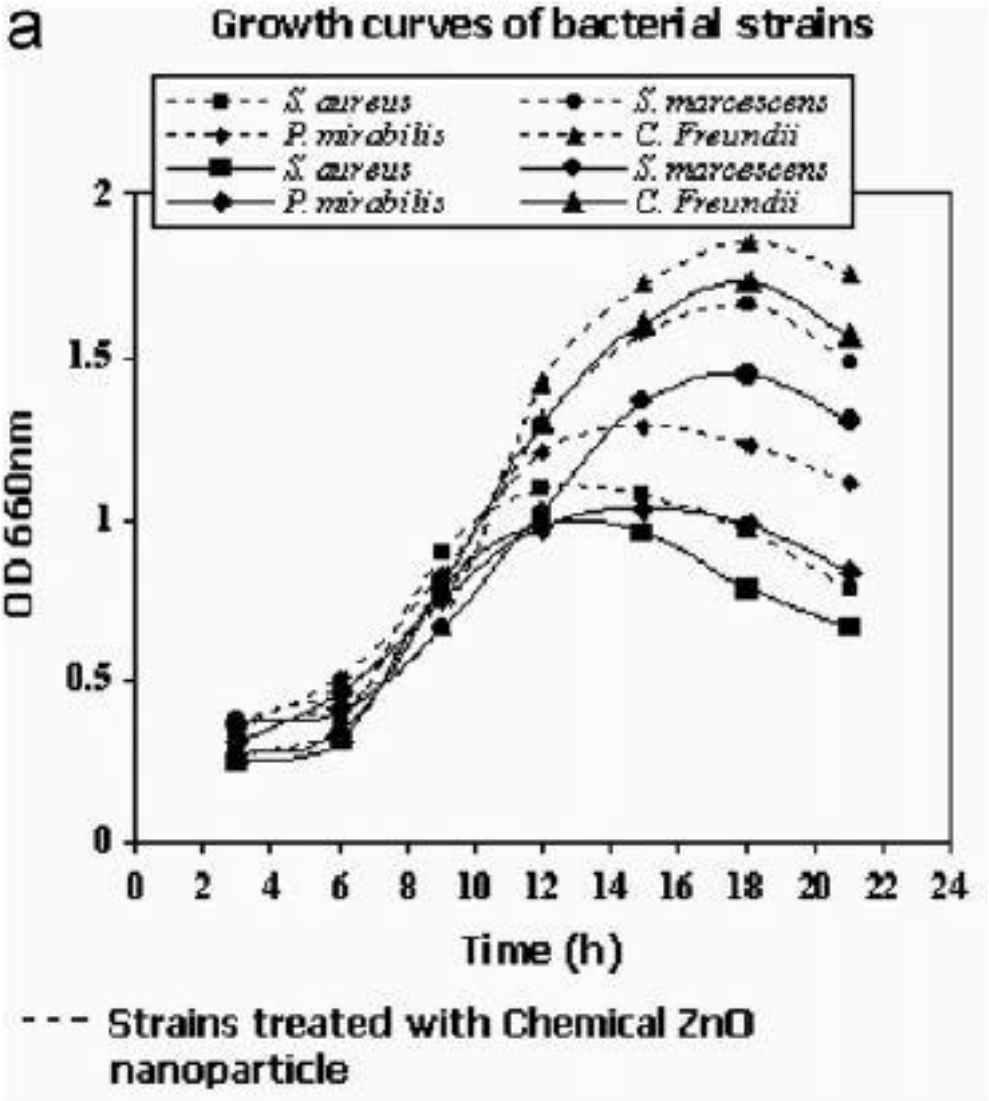
CuONPs (28)



FeONPs (29)



ZnONPs (30)



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